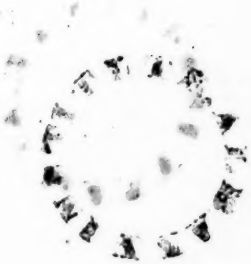

VIEW OF THE DETATCHED MASSES OF TRAP ROCK AT THE SOUTH WEST EXTREMITY OF PARTRIDGE ISLAND.

From a Sketch by C. T. Jackson.

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NO. V.

THE CIRCULATION OF THE BLOOD.

In order to view the blood circulating through its vessels, we must procure animals, the skins of which are transparent, and no object is better calculated for this purpose than the small tadpole. The circulation of the blood in this little animal is a most magnificent spectacle. In order to view it to advantage with the microscope, place a piece of window glass about two inches by one upon the stage; upon this the animal is to be placed without any further preparation.* The tail will now lie flat, and, being very transparent, the innumerable channels contained in it will be perfectly visible, within which the blood, consisting of globules suspended in serum, will be perceived coursing with extreme rapidity in all possible directions.

Along one side of the longitudinal tapering substance in the centre of the tail, a main conduit proceeds to the extremity thereof, returning towards the body, at a very small distance from the salient part, and in a parallel direction; from this, branches pro-

* When the animal is first placed upon the glass, it usually wriggles about, but soon becomes quiet, and ramains so for some time. Should it repeat its motion, there will always be sufficient intervals of quiet for readjustment and examination which makes this mode of submitting to the microscope preferable to any attempt to confine it. A small quantity of the water should be placed upon the glass; the power, No. 2, is the most suitable.

ceed latterally, which subdivide themselves to infinity. The subdivisions of each of the branches are joined at their extremities, thereby forming a perfect connexion between the whole. The blood proceeds from the main conduit by each alternate branch, and after passing through the various subdivisions of one branch, enters those of the next, on each side of it, by which it returns into the main conduit, and this process is repeated, until the mind is bewildered in its attempts to trace its course in all its minute ramifications.

In this description the usual term of arteries and veins have been avoided, as, in this animal, the distinction seems to be lost in consequence of the blood appearing to issue from, and return into the main conduit both in its salient and returning part, although it is probable that the returning main conduit is really a vein, receiving the returning branches, or veins, which must, in that case, pass either above or below, and not into the salient part of the main conduit or artery. As the substance in which these main conduits are inserted is much more opaque than the rest of the tail, the phenomenon cannot be so well observed, and it is, in consequence, difficult to arrive at a safe conclusion; however, enough is to be perceived to excite the wonder and admiration of every beholder.

THE BLOOD. Upon submitting the blood to the microscope, it is immediately perceived to consist of globules suspended in a white transparent serum. A remarkable fact will strike every observer, viz. there will be seen a continual motion of the globules, as if they were acted upon by some unknown agency. This motion appears completely vibratory, like a balance which has received an impulse; it is difficult to account for this phenomenon, but the following hypothesis is hazarded. This seeming tendency to motion in the globules, may be a material assistance to the impulse given by the heart, whose mere mechanical force, however great, appears hardly sufficient to propel the globules through such inconceivably minute ramifications, through which we know it does pass, previous to reaching the organ of circulation by the larger veins.

Place a small drop of water upon a slip of glass, into which introduce a drop of warm blood, by which means the globules will be separated, and become distinctly visible; use that power which will most enlarge them without taking away from their distinctness.

PULSATION OF THE HEART. This wonderful phenomenon may be seen distinctly in several small insects; in a bee it is observable near the neck, but the best insect to view it in, owing to its transparency, is the water flea.

FEATHERS OF BIRDS. The feathers of birds afford a variety of beauty, and differ greatly from one another, not only in their form, but in the structure of each particular part. The feathers of tropical birds have the most beautiful plumage. The handsome and delicate colors of the humming bird and the tail of the peacock are well worth observation.

SCALES OF FISHES. The scales or outward coverings of fishes, are formed with surprising beauty and variety of shape, and texture—as the perch, sole, barbel, cod, etc. The scales of eels in particular are very small;—the way of preparing them is to take them off with the forceps, and put them between a sheet of paper to keep them flat till dry. The arrangement of the scales of fishes bears a resemblance to that of the feathers of birds. The serpent and lizard have likewise scales. The scales of the sole and dace are well worth preserving for the microscope.

HAIRS OF ANIMALS. Hairs of animals are very different in their appearance before the microscope, and will furnish a great variety of pleasing observations; they are composed of small tubes or pipes. There is also in the hair of many animals spiral lines; a mouse's hair is of this description; the human hair is also a good specimen.

FARINA OF FLOWERS. The farina or scaly powder, found on the top of every flower, deserves the strictest examination. This powder, whose color is different in flowers of different kinds, was formerly supposed to be an unnecessary part of the plant; but the microscope has also made surprising discoveries here, by showing that they are minute, uniform bodies, constantly of the same figure. This powder is produced and preserved in vessels wonderfully contrived to open and discharge it when it becomes mature; there are, likewise, seed vessels in the centre, ready to receive them; and on the powder depends the fertility of the seed, for if the farina vessels were cut away, the seed would become barren. In the farina of the melon it appears as opaque black balls; in the sunflower, surrounded with sharp points; in the tulip, like the seeds of cucumbers. Gather the farina on a fine sun-shining day, when the dew is off, be careful not to squeeze or press it. Gently brush it off with a soft hair pencil upon a piece of clean paper or slides prepared with a little gumwater.

DOWN OF PLANTS, Nature has supplied the seeds of the thistles and many other plants with a down, which serves, instead of wings, to convey them from one place to another. The figures of such down are very different when examined by the glass,

some plain and smooth, others rough, and some with little hooks or clasps, to catch hold of any thing.

SEEDS. Most kinds of seeds must be prepared by steeping them in warm water to discover the minute plants they contain. The seeds of strawberries rise out of the pulp, and appear like strawberries. When viewed, seeds of the poppy, lettuce, thyme, parsley, and a thousand others, afford delightful entertainment. The fungus, or puff ball, when crushed, seems to the naked eye like a smoke, or vapor. When examined with the highest power, it is found to be composed of little globules of an orange color.

LEAVES. The leaves of plants are full of veins or ramifications, which convey the juices. The leaves of the yew are full of holes, like the honeycomb. The sage leaf appears full of knots, or little beads.

CUTTINGS OF WOOD. The air vessels and pores of wood appear wonderful in their figure and variety when shaved off as thin as possible. Fir and cork are the best for examination; but all the kinds of wood may be rendered fit for the purpose. It is advisable to have several slides filled with the different kinds of wood, both American and foreign. In a piece of cork, no larger than the eighteenth part of an inch, sixty cells were numbered in a row; whence it follows, that one thousand and eighty are in the length of an inch; one million, one hundred and sixty-six thousand, and four hundred, in a square inch. From the pith of trees cut so that they become transparent, the vessels may be seen. The pith of elder is a beautiful object for this purpose.

MOSSES. Mosses of all kinds are agreeable objects, and appear by the microscope to be as perfect in their parts as the largest trees; those which grow on the rocks and coast of the sea exhibit amazing beauty.

SAND. There are many sorts of sand on the sea shore, or within land; their varieties are very agreeable to examine; some have angles and rough coats; others, the most beautiful polish, and as transparent as the diamond.

SPONGE. Sponge is a plant and appears to be composed of minute tubes, or vessels, which by their capillary attraction, is the cause of its absorbing so much water. The fibres should be examined separately.

MOULDINESS. All kinds of mouldiness on decayed fruit, bread, etc. the microscope discovers to be exceedingly minute plants, bearing leaves, and in every respect, developing the same beauty and regularity as the leaves of trees.

THE METHOD OF PREPARING SALTS FOR VIEWING THEIR CRYSTALLIZATIONS. After dissolving the salt in water sufficient

to saturate it, and being perfectly dissolved, let it rest for a few hours; the solution being thus prepared, take up a single drop and place it on a slip of glass; spread it gently over the glass, as level as possible; hold it near a fire or candle, to give it a gentle heat. When the edges begin to look white having your microscope ready, place the glass, and you will see the formation of the crystals; when the action once begins, the eye should not be taken off, for the figures, in forming, alter every instant till perfect. If you provide yourself with several small bottles, a collection of the solution of the different salts may always be in readiness for the microscope, and by a variety of combinations, you may produce several thousand subjects for examination—a sight no one can behold without delight. As soon as they become formed, they are either cubes, rhomboids, pyramids, or certain regular figures, showing always the same sides or angles, in different substances. The following are the best for this purpose. Nitre, rock salt, Glauber's salt, sal ammoniac, hartshorn, green vitriol, white vitriol, and salt of amber.

The following description of the formation of the crystals of alum is taken from Mr. Baker's work on the microscope. 'The configurations of this salt abound with beauty and variety; place a drop of this solution on the glass, and, gently heated, it exhibits at the beginning, a dark cloud, which appears in motion near the edge, and runs swiftly through to the right and left, till they join; these, when examined, appear to be salts shot into slender lines, which cross one another at right angles.

'Crystals of Silver. These form a beautiful opaque object. In a drop of nitrate of silver, put a fine piece of copper wire, or the point of a pin; place it directly under the microscope, and the crystals will extend till the fluid is evaporated; this object may be permanently preserved: take a piece of Bristol card paper of the required thickness and of the same size as the glass to which it is to be fixed; punch an aperture in the centre of the card, then, with gum or paint, fix it upon the glass, place a drop of the solution of nitrate of silver within the aperture into which drop a small particle of copper; when the crystals have formed and the evaporation subsided, cover the aperture with glass or talc.

'By dissolving any mineral in muriatic or nitric acid, and placing it under the microscope, you will perceive beautiful crystals formed.

'Common Salt. Place a single drop of water in a glass, and put a few particles of common salt in it; give it a gentle heat till the water is evaporated, and you will have beautiful crystals in the form of cubes. Epsom salt will be formed into six-sided

prisms, alum into octagons, crystals of nitre, saltpetre, and green vitriol into the same form. To obtain crystals of camphor, place a drop of spirits of wine on a glass, hold it over a candle; when evaporated, place it on the microscope, and they will be seen.'

To find the Magnifying Power of the Microscope. Place a micrometer upon the stage, (one of the two-hundredths of an inch will be the most useful for this microscope,) and adjust it to the focus of the power in use. In order to ascertain how many times the squares are magnified, no more will be necessary than to ascertain the size of the magnified image of one of them, and the best method to do which is the following:—on several pieces of card rule a few squares which bear a known proportion to an inch, beginning at about three-quarters of an inch; and decreasing very gradually, until you arrive at a tenth of an inch. The use of these pieces of card is exemplified by the following example.

Suppose the lowest power to be in use, with the above micrometer upon the stage, adjusted to the true focus, compare the squares upon several of the pieces of card, and select that which contains squares of the same size as the magnified image; and having previously noted upon each piece of card the proportion each square bears to an inch, you immediately know the size of the magnified image, which in this instance is indicated by the card to be a tenth of an inch; and as the two-hundredth of an inch is contained twenty times in the tenth of an inch, so many times is the length of an object magnified; and as the breadth is magnified in the same proportion, the square of twenty must be taken, which is four hundred, the true magnifying power.

The following are the different magnifying powers of the microscope.

	Single.	With the Compound Body.
No. 1, the lowest power magnifies .	100	625 times.
No. 2, second power ditto . .	144	900
No. 1 & 2 combined together, 3d power,	400	2500
No. 3, fourth power ditto . .	4225	26,000

Other powers may be added to this microscope as described in the table.

N. B. The *height* of an object being magnified in the same proportion as the length and breadth, the cubes of the magnified diameters might be introduced in the above scale, although it must be admitted, that the height is, in a great measure, lost to the eye, in consequence of its being perpendicular to the object; therefore, in estimating the magnifying power, the cube is usually rejected.

To find the Magnitude of a Minute Object. The most correct and readiest way on all occasions to find the magnitude of an object, is to take a piece of glass, divided into any number of parts, or lines, of 100 or 200 to the inch; it may be placed on the stage, and a drop of water, or any other object put upon it. Find what proportion the object bears to the space within the two lines, and if it take the whole space, it is one or two-hundredth part of an inch, according to the scale.

The Works of Art and Nature compared together. Upon examining the edge of a very sharp razor, it will appear as broad as the back of a knife, and full of notches. The point of a small needle, though extremely fine to the naked eye, will appear through the microscope full of holes and scratches; but the sting of a bee, viewed with the same, will appear beautiful, without a flaw or blemish. A piece of fine muslin, or lawn appears like a coarse lattice, and the threads like ropes; the same with fine lace; but the thread of a silkworm or the web of a spider, will appear perfectly smooth. The smallest dot made with a pen appears a vast irregular spot, rough and jagged. Thus sink the works of art; but in those of nature, even in her meanest productions, nothing will be found but beauty and perfection.

What we know at present of things near and familiar is so little, that there remains a boundless space for our inquiries and discoveries in the works of nature; and the more we inquire into them, the more comprehensive and just will be our ideas of the power, wisdom, and goodness of the Creator.

The following is a list of the principal objects which afford the highest entertainment and instruction by the microscope. They may be divided into the following classes, viz:

I. Such as have their whole body, form, and parts magnified and exhibited in one microscopic view; as

The Louse; the Flea; the Bug; the Mite; the Eels in Paste, Vinegar, etc. the Animalcules in Fluids; very small Flies and Insects of all sorts; the smallest kinds of Plants, Mosses, Mouldiness, etc.

II. The small parts of animals, viz:

The Hair of the Head, Horse Hair, Mouse Hair, Hog's Bristles, etc. the Human Cuticle, or Scarf Skin; the Papillæ Pyramidales in the Skin; the Fibrillæ of Muscles, Nerves, etc. the Ramification of Arteries and Veins; the Lymphæducts, Lacteals, and other fine Vessels; the Blood, etc. the Circulation of the Blood in the Fins of Fishes, the Tails of Tadpoles, and of Wa-

ter Newts the best of all; the Nails and Hoofs cut into thin slices; the Plumulæ or Plumage of Feathers; the Pith of a Feather cut transversely; the Color and Tints of Feathers, Eggs, etc. of Birds; the Eggs of all kinds of Insects; the Antennæ or Feelers of Gnats; the Eyes of all Insects, Shell Fish, etc. the beautiful Head of a Flesh Fly; the Annuli or Rings, on the Bodies of Insects; the Wings of Gnats, Flies, etc. the Wings of Scarabæi, or beetles; the Wings of Butterflies, Moths, etc. the Sting of a Bee, Wasp, Hornet, etc; the Eyes of Spiders: the Exuviæ, or cast Skins of Spiders; the Apparatus in the Mouths of Spiders; the spiral Probosces of Butterflies, etc. the Teeth in the Mouth of a Snail; the Eyes on the Horns of Snails; young Spiders, Caterpillars, etc. just hatched; the Web of Spiders, Caterpillars, Silkworms, etc. the Chrysalides, or Cases of Insects; the Thecæ of Moths, Caddis worms, etc. the Scales of Fishes, Serpents, etc. the Scales of Eels in particular; the transparent Fins of Fishes and Eels; the Spiculæ, or Prickles, of Seal skins, the Ovaria, or Sperm of Fishes; the minute sorts of Shell Fish; the fimbriated Parts of Crabs, Lobsters, etc. the Excrements of Scollops, etc.

III. The third class of microscopic objects are of the vegetable kind.

The Plantule in the Fruit, or Kernel; the Corpuscules of the two Lobes macerated; the Orifices of Air vessels in the Roots and Branches; the Orifices of the Sap vessels in ditto; the Cortext or Bark of Trees in general; the vesicular Substance of Cork in particular; the ligenous Fibres in the internal Bark; the spiral Fibres of the Vessels in a Vine Leaf; the web-like Warp and Woof in rotten Wood; the Pith of Elder, and other like Plants; the transverse Section of Kex, Bramble, etc; the transverse Section of the Root of Fern, etc. the Involucra, or covering of Gems or Buds of Trees; the aromatic Balls on Leaves of Sage, Thyme, Mint, etc. the catenary Pearls on Sowthistle Leaves, etc, the Pellicle, or thin Skin of macerated Leaves; the Papillæ and Pores in the Pellicle of the Houseleek; the Particles of the Parenchyma of macerated Leaves; the Ramification of Vessels in ditto; the Duplicature of Vessels in ditto; the transparent Blades of Grass, Corn, etc. the Stings of Nettles, and their Juice or Liquor; the unguiculated Tenters, or Hooks of Clivers, etc. the Stamina on the young Shoots of Filbert trees; the Lanugo, or Down, on the Leaves of Plants; the small Flowers of Plants in general; the Colors of the Petela or Leaves; the Farina or Dust on the Stamina; the Style, Matrix, etc. in the Attire of the Flowers; the succulent pulpy part of the fruit; the small Seeds of Plants

in general; the Seeds of Fern, Hart's tongue, etc. in particular; the Seeds on the stems of mushrooms; the whole of sea Plants of every kind; the Variety in the Surface of Coralines; the Particular Texture of Sponge; the minutest Shells of every sort.

IV. The fourth class of objects proper for the microscope are of a miscellaneous nature, the principal of which here follow:

The edge of a Razor, Penknife, etc. the Point of a Needle, Pin, etc. the polished Surface of Metals; the Print, or Writing, on Paper; the Substance of Paper itself; the Contexture of Linen, Cloth, etc. the finest sorts of Sand; the Particles of different kinds of Earth; the various colored Particles of Mundick; the Surface and Substance of Ores and Metals; the Efflorescences of sparry Exudations; the Salts of Sea-water evaporated; the Salts of Vegetable Lixivia; the Salts of animal Substances, the Salts of Crystals of all Metals; the Crystallization of Salts; the Parts of the smallest Flakes of Snow; the hexagonal Cups of White Frost; the frosty Vegetation on GlassWindows; the Effervescence betwixt Acids and Alkalies; the ignited Particles in striking Fire; the Ashes of burnt Paper, Linen, etc.; the Teeth of fine Files, Rasps, etc. the Threads on the finest Screws; the Smallest Microscopic Glasses themselves.

PHRENOLOGY.

DR. SPURZHEIM'S LECTURES.

'Know then thyself, presume not God to scan,
The proper study of mankind is man.'

[Agreeable to a promise expressed in our last number, abstracts from the lectures of this distinguished Phrenologist are now presented. A concise view of the principles and foundation of the science having already been given, (No. ix. Vol. 2d) it is deemed unnecessary to repeat them, as laid down by Dr. Spurzheim, except in so far as he had given them a more vivid and interesting character. Many of the valuable remarks on education and those of a purely philosophical character have been omitted as not strictly adapted to a work devoted to Natural History.

From the necessity of frequently clothing the ideas in his own language, and the impossibility of incorporating the Doctor's manner and expression into the sketch, we are aware that the abstract is inadequate to convey any just idea of the intellectual treat, which a large and most respectable audience have so highly enjoyed, to those who have not participated.

The notes, however, are offered as, in some measure, illustrative of the interesting and important science of Phrenology.]

Phrenologists, dealing as they do, in spiritual subjects, state facts generally, more or less, and not with perfect precision as in the exact sciences. This necessarily results from the very nature of their science, but does not, in any degree, impair the confidence due to genuine phrenological deductions.

That philosophy of the mind which is called metaphysics, is unsatisfactory for three very cogent reasons. In the first place, there is little or no unanimity among the metaphysicians. Some recognize the existence of a power in the mind, which others deny, and *vice versâ*. Hence there must be a radical error in the system, since the true philosophy must be universally and unalterably the same. Besides, the language of metaphysicians is variously interpreted, which renders the diversity of opinion still greater. But the chief objection to the old theory or rather theories of mind, is, that they are totally unsusceptible of practical application. Such surely would not be the case with a just and true analysis of the human faculties. Some of the most modern works indeed, are improvements upon the ancient speculations, and inasmuch as they are so, they are strictly phrenological. As long as we go with received opinions we are considered right; yet the rational method obviously is to go to nature, and observe, compare, and infer. We perceive therefore that the fundamental error of metaphysicians was that they prepared a system, in their closets, founded solely on individual consciousness. Dr. Gall proceeded in a manner diametrically opposite, but, like most philosophers at the outset of their systems, he committed some faults. One of the principal of these, was the habit of naming the powers from the actions. As the latter are generally the result of combinations and not of individual powers, this was evidently an inconsistent method. The effect of this procedure was also very prejudicial to phrenology, for Dr. Gall recognized an organ of thieving &c. thereby conveying an idea, that certain bad propensities were, in his view, inherent in our natures. The powers, however, in themselves are neither good nor bad, properly speaking; their design however is, like all the Creator's beneficent purposes, eminently and truly excellent. Their evil action is a perversion and not a legitimate effect.

Little need be said of the importance of an accurate and extensive knowledge of human nature to the medical man, the teacher, and the divine. Such a knowledge would produce a most complete but auspicious revolution in education and popular opinions; and such a knowledge the phrenologist confidently believes it in his power to afford.

In the first place, there are several familiar instances analogical

with phrenology. We know that there are peculiar temperaments, and that these affect intellectual development.

Thus, an individual having the lymphatic temperament, is slow in his intellectual operations, and instruction must be adapted to this condition of mind. The nervous temperament, on the contrary, so common in this country, uniformly co-exists with activity of intellect; while the bilious temperament is most frequently accompanied by an excellent judgment, but bad memory. Now the phrenologist perceives similar and remarkable correspondences between the mind and another physical portion, the brain; and he asserts that this cerebral part is the organ of the higher faculties, and absolutely necessary to their manifestation. Among the evidences on which he bases his theory are—that idiots and persons whose mental vigor has declined through age, are deficient in brain. Remarkable differences of mind, are observable in man, and a corresponding difference in cerebral organization. It is as impossible, however, notwithstanding certain prevalent notions, to measure the developments mathematically, as to attempt the same thing, in regard to the muscles or optic nerve; the size of which, is, by no means, proportional to their powers.

To the objection of medical men that the brain being impaired or injured, the mind still manifests itself, the phrenologist answers, that the brain is double, and consequently one organ may be destroyed while the other remains, and the mental operations will go on as when a like accident happens to one eye, ear, or olfactory nerve. Again, it is said, that skulls are not equally thick, and therefore no just idea can be formed respecting the cerebral development, by exterior measurement. If thick skulls or even unequally thick ones, were common, the argument would be more weighty; and when such instances are adduced, the history of the individual should be known, in order to enforce them. Phrenologists consider children, six months old, as subjects for observation; and experience has proved that important cerebral changes occur until the age of forty years. Among animals there is observable, throughout nature, a peculiar instinct which leads them to take care of their young. In some species this is only displayed by the female, in others by both sexes, as the canary birds, who share not only the labor of rearing, but also of hatching their offspring. This instinct is also universally prevalent among the human race. But there is a striking difference in this respect. Some mothers consider the care of their children as the greatest happiness, while others view the same duty as a burden. And there are persons who immediately take an interest in every little being they meet, while in other minds no such sentiment is exci-

ted. In persons thus, as it were, intuitively disposed to the care and love of children, the posterior lobe of the brain is always large. Even very young persons thus organized, must have a doll; and among animals, the like variation as to the feeling and corresponding discrepancy, as to the organ, is evinced. The monkey tribes for example, whose care of their offspring is remarkable, have the posterior lobe much elongated. The faculty is called *philoprogenitiveness*, and is generally larger in women than in men.

Animals are prone to remain in certain places, and in considering the cause of this, an interesting philosophical inquiry arises, viz. How far exterior circumstances are the cause of powers?—In education it constitutes an important subject of investigation, to discover what is derived from nature and what from circumstances. According to Phrenology circumstances never give talent, though they are important aids to its development, and in this, but in no other sense, is there truth in the saying, 'misery is the mother of invention.' Give materials to the beaver and he will build, yet obviously his instinct leads him to the act, though the materials were requisite. Had there been no French Revolution, there would have been no Napoleon.

Birds choose localities for their nests very variously. Some choose a bough, others a hollow tree, one a water-cliff, and another the cottage roof. The Hare, as is well known, manifests a strong attachment to the place of his nativity. These, and innumerable other instances of a like nature, occur throughout the animal kingdom. When we turn to man, we find this disposition no less evidently manifested, though in different degrees. There are wandering tribes, and there are those who settle at once and permanently. Some individuals desire to return to a distant home, though all friends and relations have long since departed. And an individual who attended the phrenological lectures on the continent, came six miles in the evening, for that purpose, but could not be induced to sleep out of his own house, even for one night. He had the part of the brain at the upper end of the occipital bone very much developed. This organ is more or less developed, according to the strength of the propensity, and is called *inhabitiveness.*

Among the means provided by the creator, for the preservation of the race, is a tendency among animals and men to defend their rights. This is evinced among birds when they return to their nests in the spring, and wage war with the hapless intruder who has pre-occupied them, and it is universally exhibited. The attempt has been made to attribute this manifestation to muscular power, which, it is said, inclines to vent itself in action. If

such reasoning was cogent, animals would incline to fight in proportion to their power. This however is not the cause. A wren will defeat a much larger bird; we often see a large dog run away from a small one, and a diminutive man is as pertinacious in asserting his rights, and as pugnacious in maintaining them, as a taller or more portly individual. Their explanation therefore is not satisfactory, and repeated observation proves the assistance of an organ, and also the inateness of this propensity. The representations of the ancient gladiators show this organ large in them, and also among the wrestlers. Among animals the horse presents an interesting subject of attention in this respect. In this country and in England shy horses are very common. In the latter remarkably so, which peculiarity is explained when we learn that narrowness of head is deemed a mark of beauty, and the race propagated on this principle necessarily have the organ small. It is remarkably small in very timid horses, and is called *combativeness*.

Phrenology, in common with all other sciences, has its difficulties. In examining the organs of the lateral region, for example, it is necessary to touch the head, not only on account of the hair, but also because of the intervention of muscles. We must likewise attend to the dimensions of the individual cerebral parts, in order to judge of the organs, for this consideration involves very important results.

No physiologist need be told, that short and voluminous muscles are more indicative of strength, than long and slender ones. We frequently see children who are remarkably active and unsusceptible of fatigue, but at the same time are incapable of lifting any considerable weight; this however is readily accomplished by a child having less general activity. In the former case, the muscles are long and slender, and in the latter short and thick.

The phrenologist constantly meets with analogous instances in regard to mental phenomena. There are individuals who are constantly reasoning, yet possessed of little depth of understanding, whose powers are ever active, yet accomplish nothing *great*. On the other hand, there are persons exhibiting very little mental activity, but when once engaged, produce grand results. Hence an elongation of the cerebral fibres is regarded by phrenologists as indicative of *activity*, and the contrary as evidence of *energy* or intensity in the mental powers.

In view of these and similar facts, great attention to the *limits* of the organs is obviously very requisite, in measuring the cerebral developments.

In proportion as the organs are necessary for the preservation of man, and the nearer they approach to animal instincts, the

farther back in the head they are situated. If a verticle line be drawn from the bony elevation behind the ear to the crucial spine or occipital protuberance, what lies between this line and the neck is the residence of the cerebellum. This cerebellum, or little brain, is the seat of the faculty called by phrenologists *amativeness.*

Men essentially differ in the evidence they give of worldly knowledge, a deep and acute insight into matters and things, and the ways and means of promoting their particular interests.

Again, there are persons who seem to delight in going round and round instead of coming to the point, who are very mysterious, and require a promise of secrecy before communicating every trifling or well-known circumstance. And there are those who deceive and lie without any apparent temptation, and upon whose representations no reliance can be reasonably placed.

Phrenologists regard these and similar phenomena as perversions of a very requisite faculty, which they denominate *secretiveness.*

There exists in the human mind a tendency to prepare for the future. And there are individuals who have never enough, whose chief happiness consists in acquiring, who exhibit a great fondness for collecting, not for any scientific or ostensibly useful purpose, but simply, as it would appear, for the sake of accumulating. They have an instinctive sense of utility, which effectually prevents them from forgetting self. They *feel* that charity begins at home. Instances are not few, in which persons, having a good education, manifest a strong desire to appropriate whatever they can conveniently lay hands on, and the circumstances of such individuals totally exclude the idea that want constitutes the actuating motive.

Furthermore, it is obviously requisite that men should be provident, look well to the actual advantage to be derived from certain actions, and, in short, exercise a prudent foresight. Hence we possess a faculty called *acquisitiveness.* Among the perversions of this propensity, the most common is theft. All inveterate thieves have the organ large.

A mechanical turn, as it is called, or a peculiar aptitude for those undertakings, requiring ingenuity and skill, is to a certain extent common among mankind, and is likewise evinced in the labors and habits of animals.

There is a wide difference among men, in regard to this faculty, some exercising great inventive, but no mechanical talents, others very awkward in their attempts; to draw, play upon musical instruments, construct, &c. and some engaging in em-

ployments of this nature with the greatest facility. To ascribe this tendency or its absence to any other than an inherent quality, seems as vain as it is unphilosophical.

The head of Canova exhibits the organ of this faculty very prominently, as do those of a boy who excelled in cutting likenesses and of the celebrated Raphael. The Esquimaux and South Sea Island Indians, afford interesting proofs of the contrariety both of the faculty and its organ, and the French milliners, who always give a tone to the fashionable world, possess it remarkably developed. Its phrenological name is *constructiveness.*

Society is obviously a divine institution, or one resulting from the constitution of men and animals; not a compact induced by the necessity or desire of affording mutual protection; for while the little magpies, after having paired, are the sole residents of one tree, the rooks and raven species, in general, dwell in almost innumerable companies, and the timorous hare occupies some favorite spot nearly isolated from his fellows.

There are men who seem to be naturally separated, by their peculiar mental constitution, from their fellow-beings; or, in other words, they do not readily, and in frequent instances, never, attach themselves to their kind with anything like warmth or permanency.

Children grieve at a separation from their nurses or familiar attendants and friends, and yet some perceive the change without emotion. The faculty thus indicated more or less powerfully is stronger in women than in men, and is styled *adhesiveness.*

Individuals are habitually careful or they are otherwise. The infant, when moved clings to the supporting arm of its mother and gladly seeks even the most frail aid to its first attempts at walking; or, on the other hand, is remarkably bold and unconcerned.

Doubt, in the minds of many, opposes action, even after the most mature deliberation, and anxiety and watchfulness are often constantly active, and induce the frequent warning 'take care!'

Prompted by the impetus of feeling, some persons rush unthinking into action, others weigh and consider prior to the most comparatively trifling undertaking. Hope ever cheers the breast of one, and gloomy despondency darkens the path of another.

These and similar phenomena result from a greater or less development of *cautiousness*, an endowment at once necessary, and immeasurably useful to man and animals.

There are two fundamental feelings, which greatly influence our conduct. Their legitimate object is to direct us to the constant

performance of two of the most important of our moral obligations —our duty to ourselves and our duty to others.

The manifestations of the one—love of approbation, have received a variety of appellations. When evinced in efforts to attract attention by dress, manners or conduct, we call it love of distinction, in education it is styled emulation, and it shows itself in every variety of degree, from the fondness of what is called compliments, to the love of glory and fame. In Europe and this country it gives rise to numerous titles, etc. Boys are less anxious as to the opinion of others than girls.

There are people in the world who know everything. 'Twere a vain attempt to instruct them. Consequently they must always take precedence, and it would be presumptuous to question their right so to do. The first person I, is frequently used by them, and the affirmative, rather than the doubtful manner of speech, is particularly *their* habit. If insane, they are prone to imagine themselves kings. And such examples occur even in this country, and indicate the predominence of *self-esteem*. These two propensities combined create that peculiar susceptibility in regard to the behavior of others, called touchiness.

Phrenologists maintain, that man is naturally a moral and religious being; or, in other words, that he is endowed with certain feelings which lead him to morality and religion. If this be true, say many objectors, what need is there of a revelation? we answer great need. The powers which lead us to perform our duty in relation to the Supreme Being and to our fellow-beings are innate, but they require direction in order to manifest themselves legitimately and as they should. Therefore our heavenly Father has revealed himself and his will to us, and thus guided in their appropriate developments our moral and religious powers.

When we contemplate our physical organization and mental constitution, and see what infinite pains the Creator has taken to provide for our preservation, can we reasonably suppose that he has left to chance the most important of all our relations? certainly not; and accordingly we find that he has united us to himself by a strong tie.

The next question is—does the manifestation of these moral and religious faculties depend on organization? Phrenology says *aye*, and in this, as in every other case, appeals to observation.

Many dislike to admit, for a moment, the possibility of separating morality from religion. Yet common life affords innumerable instances of action predicated upon the truth, whether actual or supposed, of this very proposition. Witness the civil code

which solely refers to moral conduct, and observe how pertinaciously some men insist on *works* and others on *belief* as the condition of salvation. In reading the scriptures, it is surprising, how each marks the passage most congenial with his own views—which latter fact and numerous additional ones of a like stamp, suggests the important idea that religious feeling is not simple but combined. But phrenologists assert that there exists a fundamental feeling of this nature with its organ, which is called *veneration.*

Speaking generally, it is an easy matter to point out the distinction between man and animals, but when we come to moral feelings and reach the very line of demarcation, it is somewhat difficult to establish the distinction. There are some animals we call good, kind-hearted, &c. and instances unnumbered prove the existence of a mutual sympathy, between animals of the same and different species, which displays itself in a manner at once interesting and striking. Thus a dog has been known to convey hay to a cow, who could not reach it, and a fox in captivity was constantly supplied with food by his enfranchised companion.

The different degrees of benevolence or good-heartedness, are evinced even in infancy. Some children delight to divide their enjoyments, and others incline to a complete and isolated appropriation of whatever they obtain. And there are men ever ready to do good, and some *have no time* for it. This diversity is distinctly marked in the cerebral development as in habitual conduct. The size of the organ of benevolence being always commensurate with the relative power of that faculty in the mind.

Firmness is essential to success in every undertaking. Some men think long, but having decided, are immoveable. Others are swayed with the greatest facility. When carried to excess, firmness degenerates into obstinacy. It was large in Oberlin, and combined with veneration and benevolence enabled him to accomplish the noble enterprise which he so gloriously effected.

In making phrenological observations we should ever keep in view one important consideration, viz. that we are not to look at individual elevations and immediately deduce an inference; but first examine the different regions of the head, and see whether the occipital, lateral, sincipital, or frontal is most developed.

We have seen that the Creator has endowed us with the faculties of veneration and benevolence, but, in so doing, has he amply and completely provided for our constant and faithful performance of duty in relation to himself and our fellow-beings? Evidently not. And first as regards religion, we perceive the influence of a fundamental feeling essential to its growth, prevalence and power. If proof were wanting, the strong tendency to reli-

gion, manifested in this country, notwithstanding the absence of any legal provision and national institution, affords abundant evidence of the effect of the faculty under consideration. It shows itself in the love of the wonderful, and faith in supernatural agencies, so common among mankind. Missionaries frequently complain of the attachment evinced by savages to their sorcerers. The Romans generally attached a momentous importance to the direction of the flight of a crow. We speak of Johnson as superstitious, and there is a very well educated individual abroad, who actually suffered, if by chance a pin should fall point towards him. It is very common to meet with persons prone to attach an extraordinary meaning to every trifling event. Observe the great practical result of an admission of this truth. It explains many of the diversities among christians, since those who 'hear an inward voice,' and admire the mysticism of certain doctrines, feel this from a predominance of the faculty entitled marvellousness, but while they act from this impulse, they cannot in view of its spring denounce others who, from their very constitution, cannot sympathise with them. Martin, who was arrested in London for setting fire to the cathedral, and who declared he was incited to the act by a voice within him, had the cerebral part where this organ lies strongly marked. And Dr. Priestly and Price who could never agree, and never would have agreed, exhibited a corresponding difference in respect to this faculty. The feelings in themselves are blind, and any one who acts solely from their impetus will necessarily err. The Creator has taken care of us, and given us understanding as a guide. The phrenological system considers the powers of the human soul as two-fold intellectual and affective; the essence of the former is *to know*, of the latter *to feel*. Thus the appetite simply induces us to take food, but it is the part of the understanding to direct our choice in selecting it. Veneration inspires a disposition to reverence, without specifying its object; and cautiousness induces a prudent regard for our safety and well-being; yet if unenlightened we might, under its influence, fear even our own shadow.

Most philosophers, from Aristotle to Locke, ascribe the commencement of mental activity to external impressions, derived through the medium of our senses. Phrenologists, on the other hand, maintain that the mind acts through the spontaneous incitement of the affective powers, and that mental activity does not depend upon the senses. The senses do not produce the intellect, and we cannot measure mental capacities according to the senses. For we find many animals much more acute than man, in regard to their senses, yet how infinitely inferior as respects

higher endowments. Yet some philosophers refer most of the wonderful effects, attributed to the senses, to the touch alone. 'Man,' say they, 'is furnished with very delicate nerves at the extremity of his fingers, by the use of which he is brought into intimate acquaintance with external objects, and thence his mind is excited to action; while the animals, being covered with hair, are not possessed of so susceptible a sense of touch.' This intervention of hair does not, however, afford a satisfactory proof of this desideratum as applied to animals, and besides there are numerous instances of the spontaneous activity of the mind, without the aid of the senses. In Scotland there is an interesting example. James Mitchell was born blind, and deaf, and if now living is thirty-five years of age. His intellect has ever been remarkably active. He soon became acquainted with persons and things, and liked or disliked the former, forming his sentiments solely by the sense of smell. He had *secretiveness* very large, and when quite a lad was fond of shutting others in a room. His sense of property was also remarkable: he once met an individual on his father's horse, and immediately made signs for him to dismount. He was fond of smoking, having acquired the habit when quite young. He was allowed however but four pipes a day, but when absent from home, he often obtained additional pipes, which he enjoyed after his customary quantum had been allowed, exercising all due caution in the matter. He used *destructiveness* to evade certain employments which were occasionally assigned him, and having once ventured to crawl over a board which bridged a deep stream near the house, his father employed a strong man to watch, and when he repeated the experiment, to tip the board and then rescue the child; thereby giving him a sensible warning of his danger. He so well remembered the lesson that a year afterwards, when a playmate offended him, he took him in his arms, and dowsed him into the stream. There is, as is well known, a young lady in Hartford Asylum, Conn. 28 years old, destitute of hearing and sight, who yet performs many skilful operations, has a particular friend of her own selection, dresses her hair by feeling of the head-dresses of the ladies about her, and following the mode she likes best; and moreover, recognises her property, distinguishes individuals, &c. by the sense of smell.

The senses do not acquire their functions from one another. Each sense has its peculiar function, and one cannot beanother. rectify another except in a general sense. Each sense gives us a notion different from the other, and we all know that in order satisfactorily to ascertain the qualities of substances we habitually use

all the senses. Again, our senses are not sufficient to give us notions of the world. For one person with excellent eyes may be far less observing than one possessing very poor ones. There are therefore certain internal faculties, necessary in order to use the senses, and there are corresponding cerebral organs. The seat of these is the frontal region. The forehead presents difficulties, on account of the occasional existence of holes or frontal sinuses, as they are called, in the anterior lobe of the brain. These however do not occur in children. The *Antiques* recognised the forehead as the seat of the intellect. In the statue of Apollo it is very large. It is not to be judged of solely by its perpendicular or retreating aspect, nor to be viewed in front, but observe the individual's profile and see how the forehead projects from the temples. Some philosophers maintain that the senses are sufficient to acquaint us with the physical properties of things. The fallacy of this idea is rendered very evident by observing the striking difference in degree with which individuals use their senses. Children who receive what is styled their first education in such a manner as to bear away from school the title of *dunces*, not infrequently manifest, in practical life, where they are engaged in self-education, an acumen and successful application quite astonishing. In treating of the faculties of the mind, we cannot follow the metaphysicians, but the powers which they deem fundamental, phrenology ascribes to the action of the individual faculties. Thus any power when active desires gratification, and accordingly *will* is exercised by each faculty, and does not form a separate constituent element of mind. The intellect desires notions, and it is interesting, in this matter, to observe the admirable provisions for human welfare. For, what notions are most requisite for us in early life? Notions of things about us, undoubtedly. And we find that children evince a strong desire for a knowledge of external objects. Furthermore, the power of this tendency depends on the cerebral part at the lower part of the forehead, just above the root of the nose. It is observable that this organ of *individuality* gradually comes out after the age of six weeks. It produces a habit of looking, is the occasion of curiosity, and is generally small on account of the general inconsistency and ignorance of mankind. There are several concomitant exterior diversities, such as breadth between the eyebrows, the angle of the eye, and the direction of the eyeball. Naturalists have the organ large, the eyebrows and eyes far apart, and the intermediate cerebral parts strongly developed.

The organs called by phrenologists, *size*, *form*, *color*, and *weight*, have likewise their residence in the frontal region, and in pro-

portion to the dexterity and taste of individuals in regard to these properties, the organs are severally developed. *Eventuality* is expressed by the verb, as individuality is by the substantive, and it is remarkable that Horne Tooke, who proposed that the parts of speech should be reduced to two, viz. the substantive and verb, had these two organs very large. This faculty induces a love of facts, events, stories, &c. It is situated immediately above individuality.

The poets have given beautiful descriptions of *Hope.* Religion admits it, and we readily recognize in the existence of this faculty, a most beneficent provision for our happiness, deprived of which the joys of life would no longer afford pleasure, and its sorrows be unsusceptible of mitigation. It is found that individuals greatly differ in respect to this faculty. There are the *optimists* ever cheerful, and those who constantly fail in plans only to enact new ones on their ruins, and start again with renewed *hope;* these we call the schemers. Circumstances auspicious in the highest degree, inspire no felicity into the minds of some. A settled gloom darkens the path and obscures the sunshine of happiness. These possess little hope, and the cerebral part ascribed to this organ is small; while in the former class it is strikingly large.

The existence of a moral sense has been a disputed proposition, and many still doubt it, while others strenuously maintain that there is in man an internal monitor, which directs his conduct, and punishes or rewards him according to his deeds. The civil law, however, does not leave the punishment of crime to this conscience, as it is termed. From which, as well as from the fact, that many excellent men aver that they have and do experience effects attributed to it, we infer that it exists, but, like the other faculties, in various degrees. It is not however defined by phrenologists as an absolute and sure guide in right conduct, but it occasions a *desire* to know the right and to do it. It is large in children, who avowedly have an acute sense of the justice of conduct, and it is found to diminish as they advance in life. This may be ascribed to want of cultivation. While some address the love of approbation, and others self-esteem, to induce virtue, and while many are martyrs to acquisitiveness, vanity, &c. how few appeal to the *sense of right* innate in the child, or measure their own actions by the standard of justice within them! *Conscientiousness* is obviously as necessary to benevolence as marvellousness is to religion. It is small in most criminals, and in view of its powerful influence merits the profound attention of the divine, moralist and teacher.

Some religious persons dislike to see powers destined to give

us cheerfulness, in successful action. Yet there are such powers, their object is as beneficent and good as all the other designs of the Creator, and their legitimate gratification is alike due to nature and intimately connected with the advancement of the best interests of humanity. And first there is poetry. 'The poets are born,' is an ancient expression, and the variety manifested by them, in the development of their peculiar faculty, is phrenologically explained by its combination. They evince it in childhood, and are disappointed to find real life so very different from their fond imaginings. A poetical vein runs through their letters, conversation, descriptions, &c. There are poets among the artists. The painters who are said to flatter their likenesses are poets, they must picture men and things as they should be, and not as they are. Herein, indeed, is the difference between poets and others. The former view nature and society through a lens which robes them in an ideal perfection, while others look on and see the plain, strait-forward, common things and ways of the world. The ancient statues of poets have *Ideality* large, and Homer excells, in this respect, every representation which has descended to us.

Some men try to be wits, but they try in vain. Others are so much so, that even the desire to spare their friends will not confine the jest. Painters show it by caricature, composers of music throw it into their airs and melodies, actors evince it by ludicrous mimicry, and those having it greatly manifest it according to their other faculties. It is frequently the vehicle of ideas, and those who have no ideas, cannot, of course, be witty. Voltaire had it so much, that even holy things suggested to his mind laughable images. His use of the faculty was evidently a perversion.

The faculty called *Imitation* is peculiarly necessary in the first stages of infant education, and hence we find children largely endowed with it. In adults it is comparatively small, but some, as artists, actors, &c. cultivate it, and therefore have it generally full. It is indeed very requisite in the fine arts, and is an important means of improvement.

Memory, according to the metaphysicians, is a fundamental power; the phrenologists, on the contrary, consider it as a state or condition of the several faculties, in the same manner as attention. On this principle, the various manifestations of memory are explicable. We all know that some individuals easily remember the places where they have once been, others the dates of events, and others a different circumstance relating to the same subject. In short one person has a good memory for one thing, and anoth-

er for another. Phrenology refers these phenomena to a modified action of the different faculties. Thus an individual who has the organ of form large, will readily recollect this quality of an object he has once seen, while all the others have escaped his remembrance. And a retentive power of mind will in all cases be evinced, corresponding to the development of the different faculties.

An interest in localities, a desire to observe them, and a skill in becoming acquainted with them, is particularly observable in some men. There is at present abroad an Irishman, who annually travels for no other purpose than to look about him, and a blind gentleman, well known to many, goes about accompanied by a servant, who gives him an account of the hills, rivers, &c. which they pass. These he carefully remembers, and thence derives a great degree of pleasure. In these, and individuals of a like character, the organ of *locality* is very large.

The diversity exhibited by children with regard to numerical operations is striking. Some find their chief amusement in counting, and will embrace every opportunity to numerate the objects presented to them, others have no like inclination; hence a fundamental faculty, depending for its manifestation on a cerebral part, styled the organ of number. Important considerations result from this phrenological fact. It seems plainly to point out the fallacy of expecting by the extensive introduction of mathematics into education to expect to create great mathematicians. Such a result is indeed only effected by the combined and vigorous action of several powers; but one deficient in the organ of number, may reason admirably on some subjects, but will fail if great numerical calculations are expected from him. Number itself simply gives a facility for counting, and may exist in one very deficient in reasoning powers. A lad who had it strong, was taken to see Garrick, in a fine piece, and when the play was over, merely evinced the impression made on his mind, by stating the number of syllables which the distinguished actor had pronounced during the performance.

[The preceding article was prepared for the press before the melancholy termination of Dr. Spurzheim's labors. We believe that his death may justly be ascribed to the devotedness with which his objects were pursued. He indeed fell a victim to his deep sense of duty. It is with sincere regret that, on account of the pre-occupation of our pages, we are obliged to deny ourselves the gratification of recording, at length, the life, labors and noble character of the great departed. His efforts in the most important, but least appreciated province of Natural History, with their splendid results, constitute the noblest monument, which even sorrowing friendship could rear. That these may be felt and valued as they should be, and the admirable example they bespeak produce its legitimate results is the fervent prayer of every enlightened friend of humanity.

'He had, for reasons of which we are not informed, selected Boston as the first place in the United States, in which he should exhibit the claims made on behalf of the new science, originally promulgated by his friend and master, Dr. Gall, and afterwards extended and materially improved by himself; and the kindness and regard with which he was received in every circle, were as warmly reciprocated on his part. If ever man found sincere friends out of his own country, we are sure, that this illustrious stranger had many such among us. Indeed, it would have been a reproach, if he who was the friend of all his fellow men, should not have found here, some of the human family who would feel towards him as his own benevolence merited.

'The science which he had so successfully cultivated,—*the science of man*—had, as he often observed to his friends, elevated and refined his views of human nature; and he believed it had preserved him from declining into a feeling of misanthropy and dissatisfaction with the world; a tendency to which, we imagine, might have been strengthened by the sense of solitude which he had peculiarly felt ever since the loss of his wife, who died about two years ago. Whatever may have been the cause—whether it were his natural temperament, or the cause here stated, he manifested a philanthropy not surpassed in any age; and he was a living example of the beautiful sentiment of antiquity—Homo sum, nihil humani a me alienum puto.]

STRUCTURE OF THE EARTH.

[From 'the First Lessons in Natural History.']

All geologists are agreed that our present continents were once covered with water. This is proved by the remains of marine animals imbedded in the strata which lie on the summits of the highest mountains. The structure of the globe as far as we are acquainted with it from the intersections made by rivers, by the action of the sea upon the coast, and by mining operations, consists of beds of different kinds of stone, which generally increase in thickness as we descend deeper. Stratification, in its simplest form may easily be conceived, by placing a closed book with the back resting upon the table, and raising the opposite edges a little; the book may represent a thick mineral bed, and the leaves a series of strata. In nature we frequently find the strata much broken, and thrown out of the original position. Where any series of strata are wanting, a question naturally arises, have they been carried away by some sudden inundation, before the upper strata were deposited, or have they never extended to that place? In some instances it is certain that the strata have been carried away from particular situations, as in some of the excavations which have formed valleys, in which the strata that terminated on one side of the valley may be discovered again in the hills on the opposite side. The substances of which the strata are composed, are argillaceous, calcareous, or siliceous earth, which are generally more or less intermixed or combined. The strata of clay,

or argillaceous strata, being water-tight, give rise to springs, as arrest the water that runs through the porous strata, and convey it to other situations. The inclinations of the strata, with the breaks and inequalities, render the globe habitable, by distributing the waters over the surface.

According to geologists, all the substances which now constitute rocks, mountains, and soil, on the surface of the earth, were originally existing in a state of solution in the waters of the 'great chaos.' It is supposed, that they, at the beginning surrounded the globe at a great depth. The substances or materials of rocks thus swimming in the primitive ocean were supposed to fall gradually to the *bottom*, sometimes by chemical, sometimes by mechanical means, and sometimes by both together; and in this manner all the rocks were formed which we now find on digging into the earth. The inequalities of mountains and valleys on the surface of the earth, which were thus produced as soon as the waters began to subside, gradually rose out of the primitive sea, and formed the first dry land. The rocks which were first formed in this manner are called *Original or Primary Formation;* because no fossil remains of animals or vegetables, nor any fragments of other rocks were found imbedded in them; hence it was supposed that they were formed before the creation of organized beings. The rocks of this class, are for the most part extremely hard, and the minerals of which they are composed are frequently more or less perfectly crystallized.

The formation of these rocks, however, did not, it seems exhaust the materials floating in the waters, for the deposition went on, and a class of rocks were formed called *Intermediate or Transition Rocks;* because, on their appearance above the water, the earth was supposed to pass from an uninhabitable to a habitable state, for nearly all the rocks contain organic remains of the lowest class of animals, which are considered as forming the first link of the chain of animated beings. They contain also fragments of rocks of the primary class, and are frequently interposed between those of the primitive and secondary formations, and often partake of the characters belonging to both. The rocks of the primary and transition classes are the principal repositories of metallic ores. Rocks of the transition class, however, are not universally interposed between the primitive and secondary ones, for in some instances the transition series are entirely wanting.

After the formation of the primary and transition rocks, it is supposed that the water suddenly rose over them to a great height covering them in many places, and it again subsided with a new formation called *Lower Secondary Rocks.* They are nearly all

distinctly stratified, and contain an abundance of fossil remains of vegetables, analogous to ferns, palms, and reeds; while those of the transition class, contain almost exclusively the remains of marine animals.

After these changes, another most remarkable revolution of the globe took place, and another class was formed called the *Upper Secondary Rocks*. The organic remains of the strata of this class are chiefly those of marine animals, but of different genera and species from those of the transition class. It is in the rocks of this series that we first meet with remains of animals of a higher class, which possessed a brain and a back bone; they are all of the oviparous order, such as the fish or lizard tribe. This upper series appears to have been formed not only under different circumstances from the lower, but after a long interval, during which the surface of the globe had been much fractured and displaced; for the upper series do not lie regularly upon the other, and parallel with them, but they cover the edges of the lower strata in a confused manner.

Tertiary Strata* comprise all the regular beds which have been deposited subsequently to the chalk strata, on which they frequently repose. It was formerly supposed that tertiary strata were very limited in extent, and were confined to a few districts in Europe; recent observations, however, prove that strata of this class cover considerable portions of the surface in various countries, though there are other countries in which they are entirely wanting. Tertiary strata are the last formed or uppermost of all the regular rock formations. They consist chiefly of clay, limestone, and friable sandstone; the lower series of these strata contain numerous marine shells, while some of the middle and upper strata contain shells resembling those found in our present rivers, or in fresh-water lakes. The most remarkable fact respecting the tertiary strata is, that some of them contain numerous bones of quadrupeds of the class mammalia, but these for the most part belong to genera and species which no longer exist upon the earth.

Volcanic and Basaltic† Rocks have been either ejected from volcanoes, or poured out in a state of fusion from rents and openings of the earth's surface. They cover in an irregular manner the rocks of the preceding classes. In some situations the melted mineral matter has taken a columnar form in cooling; in other situations it fills vast fissures, called by miners, *dikes*.

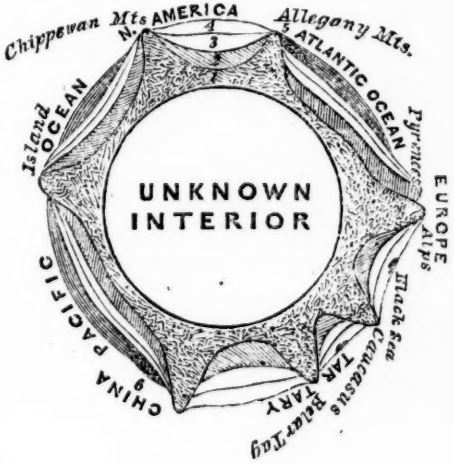
* Derived from the Latin, *tertius*, third.

† Derived from the French *basané*, tawny, alluding to the color of some of the varieties.

Alluvial or Diluvial‡ is caused by the wearing down of the rocks, by the action of the weather and other causes, and the washing away of the worn materials by rains and streams of water. Considerable portions of many countries are covered with thick beds of it, which consist of beds of sand or clay, fragments of rock and loose stones, more or less rounded by attrition. In some situations these have evidently been transported from a vast distance, for frequently no rock similar to the fragments occurs within a hundred miles, or more, of the place where they are deposited. They indicate the action of mighty inundations which have swept over the face of our present continents.

The classes of rocks above enumerated have their appropriate mineral productions, and with the exception of rocks of the first class their appropriate organic remains; and it would be as useless to search for regular beds of common coal in the primary rocks, as it would be to search for metallic veins or statuary marble, in the tertiary strata.

The following plate represents a section of the earth between 40° and 45° north latitude. Fig. 1 denotes the primary formation; 2, transition; 3, the lower secondary; 4, the upper secondary; 5, tertiary; and 6, alluvial or diluvial formation.



‡ Alluvial is derived from the Latin, *alluvia*, an inundation of water. Diluvial is from the Latin, *diluvium*, the deluge or flood.

METEOROLOGICAL JOURNAL,

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[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inches.*
1	57	58	56	29.90	29.85	29.72	Cloudy	Rain	Rain	N. E.	N. E.	N. E.	0·78
2	56	64	55	29.73	29.78	29.78	Fair	Fair	Fair	N. E.	E.	S. W.	
3	49	60	54	39.74	29.80	29.82	Fair	Fair	Fair	N. W.	N. W.	S. W.	
4	50	64	57	29.82	29.83	29.86	Fair	Fair	Fair	S. W.	S. W.	S. W.	0·10
5	50	68	58	29.97	30.00	30.00	Fair	Fair	Fair	W.	W.	W.	
6	48	58	50	30.00	30.00	29.98	Cloudy	Fair	Fair	N.	N. E.	E.	
7	46	59	52	29.95	29.95	30.02	Cloudy	Cloudy	Rain	N. W.	E.	S. E.	
8	50	62	50	30.10	30.19	30.28	Fair	Fair	Fair	N. E.	E.	S. W.	0.15
9	42	58	50	30 35	30.35	30.35	Cloudy	Fair	Fair	N. W	W.	S. W.	
10	48	48	63	30.25	30.10	30.00	Cloudy	Rain	Cloudy	S. E.	S. W.	S. W.	0.04
11	70	65	52	29.81	29.79	29.90	Cloudy	Rain	Fair	S. W.	S. W.	N. W.	0.68
12	48	64	50	30.02	30.09	30.12	Fair	Fair	Fair	N. W.	N W.	N. W.	
13	48	70	57	30.12	30.12	30.10	Fair	Fair	Cloudy	N. W.	S. W.	S. W.	
14	48	57	41	30.05	30.05	30.19	Cloudy	Cloudy	Fair	N. W.	N.	N. W.	
15	35	38	38	30.35	30.38	30.38	Fair	Fair	Fair	N. W.	N. W.	N. W.	
16	35	45	46	30.38	30.28	30.25	Fair	Fair	Fair	S. W.	S. W.	S. W.	
17	48	69	57	30.22	30.15	30.12	Fair	Fair	Fair	N. W.	S. W.	S. W.	
18	56	72	66	30.11	30.10	30.11	Fair	Fair	Fair	S. W.	S. W.	S. W.	
19	52	52	50	30.34	30 35	30.28	Cloudy	Fair	Cloudy	N. E.	N. E.	N. E.	
20	56	73	57	30.10	29.95	29.92	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
21	55	60	54	30.10	30.15	30.29	Cloudy	Fair	Fair	N. W.	N. W.	N.	
22	50	52	46	30.35	30.32	30.10	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.	
23	51	59	52	29.79	29.75	29.90	Cloudy	Cloudy	Cloudy	N. W.	N. W.	N. W.	0.67
24	42	50	40	30.05	30.10	30.09	Fair	Fair	Fair	N. W.	N. E.	N W.	
25	40	52	33	30.03	30.05	30.18	Fair	Fair	Fair	N. W.	N. W.	N. W.	
26	28	42	30	30.40	30.45	30.50	Fair	Fair	Fair	N. W.	N. W.	N. W.	
27	32	52	44	30.37	30.22	30.21	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
28	40	42	42	30.20	30.21	30.25	Cloudy	Cloudy	Cloudy	N.	N.	N.	
29	36	50	38	30.29	30.32	30.38	Fair	Fair	Fair	N. W.	N.	N. W.	
30	34	60	42	30.38	30.38	30.39	Fair	Fair	Fair	S. W.	S. W.	S. W	
31	40	62	46	30.34	30.31	30.25	Fair	Fair	Fair	S. W.	S. W	S. W.	

Depth of rain fallen 2.42 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.